Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and	)	WT Docket No. 14-165
	)	
Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap	)	
	)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions	)	GN Docket No. 12-268
	)	
Promoting Spectrum Access for Wireless Microphone Operations	)	GN Docket No. 14-166

COMMENTS OF AUDIO-TECHNICA U.S., INC.

Audio-Technica U.S., Inc.
1221 Commerce Dr.
Stow, OH 44224
330-686-2600

Bennet & Bennet, PLLC
6124 MacArthur Blvd.
Bethesda, MD 20816
202-371-1500

February 4, 2015

TABLE OF CONTENTS

Summary..... iii

I. Introduction ……2

II. Background …….……..……..3

III. 600 MHz NPRM ….…….…….....6

IV. Guard Band and Duplex Gap ….……..……..……..9

V. Rural Areas ……...……...……..……..13

VI. Elimination of Safe Harbor Channels . ..……16

VII. Increasing Spectrum Avaiability for Wireless Microphones .…….18

VIII. Conclusion ……..25

Summary

In seeking to implement the requirements of the Spectrum Act, the Commission has proposed rules to allow wireless microphones and WSDs to continue to operate on unused broadcast spectrum that remains following the incentive auction and in the guard bands and duplex gap that will be established under its final 600 MHz Band Plan. A-T generally supports the Commission's approach to balancing the interests of many diverse stakeholders in a changing spectrum environment. However, there are several respects in which the Commission's proposals fail to adequately account for the particular interference vulnerabilities of wireless microphones. Specifically, the Commission's proposal to require wireless microphones to operate at reduced power levels in the guard bands and duplex gap does not account for the fact that such operations will be adjacent to WSD and LTE equipment operating at significantly higher power levels and will effectively preclude wireless microphones from operating on this spectrum. A mandated power reduction will also render much of the currently deployed equipment unusable well in advance of any mandated transition period. Such power limits are unnecessary as well for newly manufactured equipment, as adoption of the ETSI emission mask proposed by the Commission will eliminate any likelihood that microphones will interfere with operations on adjacent spectrum even at currently authorized power levels. Likewise, the Commission should not require wireless microphones to access the white spaces database. Not only is such a requirement completely unnecessary, but the cost of access will serve as an impediment to small unlicensed wireless microphone users without providing them with any real benefit. The Commission also should not allow WSDs to operate at higher power levels in rural areas. Such a policy would run counter to the Commission's desire to increase spectrum sharing and efficient spectrum use. The Commission's current waiver process provides an adequate means to address individual special circumstance that may warrant increased power or antenna heights for WSD operations at higher power. Finally, the Commission should delay elimination of the wireless microphone safe harbor until after the changes proposed to its white spaces database procedures are proven effective to protect licensed wireless microphone operations in the spectrum environment that will prevail after the incentive auction

Great strides have been made over the past few years to improve the spectrum efficiency of wireless microphones and the Commission should continue to let the marketplace develop innovative products and avoid imposing government mandated policies that could stifle innovation. Instead, the Commission should revise its rules to encourage greater stability by ensuring the availability of suitable spectrum for wireless microphone use and also provide regulatory certainty that will allow manufacturers to develop and users to invest in new innovative and efficient products. A-T supports the Commission's efforts to make existing microphone spectrum more useful for product development as well as to identify new spectrum bands for wireless microphone use. A-T makes specific recommendations to that would allow better utilization of UWB technology for wireless microphones by professional users without increasing the risk of interfering with primary users in the spectrum bands where UWB operations are permitted.

.

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and	)	WT Docket No. 14-165
	)	
Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap	)	
	)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions	)	GN Docket No. 12-268
	)	
Promoting Spectrum Access for Wireless Microphone Operations	)	GN Docket No. 14-166

COMMENTS OF AUDIO-TECHNICA U.S., INC.

Audio-Technica U.S., Inc. ("A-T") submits these comments in response to the two Notices of Proposed Rulemaking released by the Commission on September 30, 2014 to deal with the anticipated loss of UHF spectrum, used by unlicensed White Spaces Devices (WSDs), unlicensed wireless microphones and licensed wireless microphones, as it prepares to reclaim and auction portions of the television broadcast band for commercial wireless applications.[1]

[1] *In the Matter of Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions,* ET Docket No. 14-165, GN Docket No.12-268, Notice of Proposed Rulemaking, FCC 14-144 (released September 30, 2014) ("*600 MHz NPRM*"); *In the Matter of Promoting Spectrum Access for Wireless*

I. INTRODUCTION.

A-T has been dedicated to advancing the art and technology of electro-acoustic design and manufacturing since 1962. From a beginning in state-of-the-art phonograph cartridges, A-T has expanded over the years into the design and manufacture of high-performance headphones, microphones, in-ear monitors, mixers and electronic products for home and professional use. In each new area, the company's goal has been to create innovative, problem-solving products. The results of these engineering and production efforts can be seen in the effective use of A-T products in a broad spectrum of applications. Audio-Technica microphones, for example, are found in daily use in major broadcast and recording studios, and relied upon by top touring musicians. A-T microphones are chosen for important installations and major events, such as the U.S. House of Representatives, the U.S. Senate, the Super Bowl, World Cup Soccer and the Olympics.

A-T has also been an active participant in the Commission's proceeding to allow unlicensed devices to operate within the television white spaces ("WSDs") and to establish rules to ensure that such operations do not interfere with licensed and unlicensed wireless microphones. A-T has not opposed allowing unlicensed operations on vacant television broadcast spectrum, but has asked the FCC to ensure that the particular interference vulnerabilities of broadcast low power auxiliary stations, particularly wireless microphones, are taken into account and fully addressed in any decision to allow unlicensed operation in the TV Bands. To that end, A-T supported the Commission's 2010 decision to set aside up to two

---

Microphone Operation; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auction, GN Docket Nos., 14-166, 12-268, Notice of Proposed Rulemaking, FCC 14-145 (released September 30, 2014)("*Microphone NPRM*").

unoccupied television channels in each market free from unlicensed WSD operation for wireless microphone use given the very real interference potential to wireless microphone services posed by operation of unlicensed devices in the broadcast spectrum.

A-T has responded to the FCC's desire to develop technology solutions that will allow unlicensed wireless devices to successfully operate in the "white spaces" without disrupting existing licensed services. A-T has developed both analog and digital wireless microphone products that have advanced the state of the art through increased efficiency both within the television band and outside of that band. To this end, A-T has invested millions of dollars in the research, development, production and launch of the world's first ultra wide band ("UWB") digital wireless microphone. Additionally, A-T manufactures a product lines that operates on frequencies available for Part 90 eligibles (sometimes referred to as "traveling frequencies") and in the 2.4 GHz band.

II. BACKGROUND

In September 2010, the Commission adopted the *TV White Spaces Second MO&O* which took several important actions that affected the availability of the TV band spectrum for wireless microphones, including adoption of the current rules under which wireless microphone users and unlicensed WSDs have access to unused TV band channels.[2] In that proceeding, the Commission retreated from its prior requirement that WSDs incorporate spectrum sensing capabilities into their equipment to protect incumbent spectrum users, including wireless microphones, and chose instead to rely primarily on a geolocation database approach advocated

[2] *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, ET Docket No. 04-186 and 02-380, Second Memorandum Opinion and Order, 25 FCC Rcd 18661 (2010) ("*TV White Spaces Second MO&O*").

by WSD interests.[3] Licensed wireless microphone operators and certain qualifying unlicensed wireless microphone operators could obtain interference protection from WSDs by reserving channels at the specified locations during the times of operation through use of the TV band databases.

From the perspective of the wireless microphone industry (including both equipment manufacturers and content creators) one of the most important steps taken by the Commission in that proceeding was to recognize that the database solution alone was not sufficient to protect wireless microphones in all cases and that further actions were necessary to ensure that a minimum amount of spectrum would continue to be available as a safe harbor for wireless microphones free from interference from unlicensed WSDs. Specifically, the Commission provided that the two unused television channels (where available) nearest channel 37 (one above and one below) would be designated for wireless microphone operations nationwide and not be made available for WSD use.[4] In expanding this safe harbor from a handful of markets to all markets nationwide, the Commission recognized the particular sensitivity of wireless microphones to external interference given their operational requirements for real time, low latency communications between transmitter and receiver.[5] The Commission also decided to preclude itinerant portable WSDs from operating below channel 21. On reconsideration, the Commission relaxed certain technical restrictions imposed on WSDs with the intent of

[3] *TV White Spaces Second MO&O* at ¶55.
[4] *TV White Spaces Second MO&O* at ¶132.
[5] *Id.* at ¶ 30.

"increasing the availability of wireless broadband services in rural and underserved areas *without increasing the risk of interference to incumbent services.*"[6]

Following passage of the Middle Class Tax Relief and Job Creation Act of 2012,[7] the Commission initiated proceedings to design a mechanism to reclaim UHF television broadcast spectrum and repurpose that spectrum for flexible use wireless services, including mobile broadband. In the ensuing *Incentive Auction R&O*,[8] the Commission recognized that the amount of spectrum available for use by WSDs and wireless microphones would be significantly reduced following the repurposing of portions of the 600 MHz Band to new mobile wireless services and the repacking of the remaining television broadcasters into a reduced TV Band. To this end, the Commission made several decisions that will have a substantial impact on the ability of existing wireless microphone users both licensed and unlicensed, to successfully operate in the post incentive auction television broadcast spectrum.

Specifically, to offset the anticipated reduction in broadcast spectrum, the Commission decided to allow WSDs and wireless microphones to operate in the guard bands and duplex gap established by its new 600 MHz Band Plan for the auctioned spectrum, thus ensuring a minimal amount of spectrum would remain available for WSD and wireless microphone use in all markets.[9] The Commission also determined for the first time to allow WSDs (but not microphones) to operate on previously restricted channel 37 thus providing new spectrum for

---

[6] *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, ET Docket No. 04-186 and 02-380, Third Memorandum Opinion and Order, 27 FCC Rcd 3692, 3693 (2012) (emphasis supplied).

[7] Pub. L. No. 112-96, §§ 6402 (codified at 47 U.S.C. § 309(j)(8)(G)), 6403 (codified at 47 U.S.C. § 1452), 126 Stat. 156 (2012) ("*Spectrum Act*").

[8] *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567 (2014) ("*Incentive Auction R&O*").

[9] *Incentive Auction R&O* at ¶ 258.

WSD operations where it was not previously available and in effect creating a safe harbor for WSDs.[10] In contrast, the Commission decided that the safe harbor channels established to protect wireless microphones on either side of channel 37 will no longer be available exclusively for wireless microphone use and should be made available for WSD operations.[11]

III. *600 MHZ NPRM*

The Commission's *600 MHz NPRM* proposes rules to implement the general policy decisions made in the *Incentive Auction R&O* relating to WSD and wireless microphone operations in the remaining television broadcast band, the spectrum that will be newly repurposed for commercial mobile operations, and the guard bands and duplex gap established by the final 600 MHz Band Plan to be implemented following the incentive auction. In place of the safe harbor channels to protect itinerant wireless microphones, the Commission now proposes to rely entirely on the TV bands databases and proposes to increase the frequency at which WSDs must re-check the database from once per day to every 20 minutes, and reduce the time required for a wireless microphone registration made in one white spaces database to appear in all other white spaces databases from one day to 30 minutes. The Commission indicates its belief that these database changes will ensure that licensed wireless microphones used for itinerant operations such as newsgathering will have access to spectrum for their operations on short notice, free from interference from WSD operations.[12]

A-T acknowledges the difficult task faced by the Commission to implement the requirements of the Spectrum Act, requiring as it does the formulation of new rules and policies to balance the diverse needs and interests of television broadcasters, displaced TV auxiliary

[10] *Id.* at ¶ 274.
[11] *Id.* at ¶ 310.
[12] *600 MHz NPRM.* at ¶¶ 189-190.

stations, new commercial mobile services, WSD operations and wireless microphone manufacturers and users. However, the rules as proposed unduly favor WSD operations at the expense of wireless microphones and, if adopted as proposed, will significantly degrade the ability of both licensed and unlicensed wireless microphones to find sufficient interference free spectrum to meet the increasing demand for the production and performance of new content.

The rules proposed in the *600 MHz NPRM* go to great lengths to ameliorate the impact of the incentive auction on WSDs by making available substantial amounts of new spectrum to compensate WSDs for the loss of spectrum that will be repurposed following the auction. In contrast, wireless microphones will effectively lose access to spectrum above and beyond the spectrum that will be repurposed as a result of the incentive auction.

Initially, as noted above, the Commission has decided to allow WSD to operate on the two channels adjacent to channel 37 that are reserved as a safe harbor for wireless microphones free from the possibility of WSD interference. By removing the safe harbor, the Commission will make up to 12 MHz of new spectrum available for WSD use. This 12 MHz is being made available for WSD use at the expense of a loss of clean spectrum available to wireless microphones.

Second, the Commission has proposed to eliminate the prohibition on the use of television channels 3 and 4 by fixed WSDs.[13] This proposed action would provide up to an additional 12 MHz of contiguous spectrum for use by white space devices in areas where those channels are not used for authorized services.

[13] *600 MHz NPRM* at ¶ 28.

Third, the Commission proposes to remove the prohibition on personal/portable WSD operation on channels 14-20.[14] This proposed action would make 42 megahertz of new spectrum potentially available for itinerant WSD devices in locations where the spectrum is not used for the PLMRS/CMRS or other authorized services. The Commission also seeks comment on whether to permit personal/portable WSDs to operate below channel 14.[15] Allowing operation of personal/portable devices on channels 7-13 would make another 42 megahertz of spectrum potentially available for personal/portable devices.

Fourth, the Commission proposes rules to implement the decision in the *Incentive Auction NPRM* to allow WSDs to operate on channel 37, which has been reserved for medical telemetry devices and radio astronomy.[16] This will provide an additional 6 MHz of entirely new spectrum for WSDs, spectrum which the Commission has never made available for wireless microphone use, in effect creating a safe harbor channel for WSDs even though they do not share the same interference vulnerabilities that are characteristic of wireless microphones.

Fifth, the Commission proposes to allow WSDs and unlicensed wireless microphones to operate in portions of the guard band and duplex gap established by its 600 MHz Band Plan[17] and to allow licensed wireless microphones to operate in a separate portion of the duplex gap. Depending on the amount of spectrum recovered in the incentive auction, the guard bands will range from 3 MHz to 17 MHz of spectrum available for WSDs and 2 MHz to 16 MHz for unlicensed wireless microphones (due to a 1 MHz buffer limitation imposed on wireless microphones but not WSDs). In all cases, the duplex gap will consist of 11 MHz of spectrum

[14] *Id*. at ¶¶ 29-31.
[15] *Ibid*.
[16] *Id*. at ¶¶ 97-124.
[17] *Id*. at ¶¶ 80-95, 158-159; *Incentive Auction NPRM*, Appendix C, Figure 23.

with 6 MHz to be used by WSDs and unlicensed wireless microphones, with a separate 4 MHz available for licensed wireless microphones and 1 MHz reserved as a buffer to protect wireless handsets operating on the newly reclaimed broadcast spectrum.

Finally, the Commission has proposed to allow fixed WSD stations to expand their operations into adjacent channels between two television stations at their full 4 Watt EIRP level in cases where the WSD can offset its center frequency to provide a minimum separation of 3 MHz from all television channels on each side of the WSD channel. In effect, this provides between 3 MHz and 6 MHz of additional spectrum that is being made available to WSDs.

Based on the foregoing, the total amount of new spectrum that the Commission has proposed to make available to WSDs ranges from approximately 84 MHz to 101 MHz. This range increases to between 126 MHz to 143 MHz if the Commission ultimately decides to allow portable WSD stations to operate below channel 14. In contrast, under all scenarios, the amount of clean spectrum available for wireless microphone operations actually decreases over and above the loss of spectrum that is being repurposed. In the case of licensed wireless microphones, the loss of 12 MHz of safe harbor spectrum is only partially offset by a gain of 4 MHz of spectrum from the duplex gap. For unlicensed wireless microphones that do not qualify for database protection, the impact is far more significant.

IV. GUARD BAND AND DUPLEX GAP

While the Commission proposes to allow licensed and unlicensed wireless microphones to operate in the portions of guard bands and duplex gap, the Commission is proposing a number of conditions and limitations that will effectively prevent wireless microphones from making any substantial use of this spectrum. Specifically, the Commission proposes that in the guard bands and duplex gap, wireless microphones would be authorized with a reduced maximum conducted

output power of 20 mW. This is half of the 40 mW permitted in the guard band and duplex gap for WSD operations and well below the 50 mW unlicensed/250 mW licensed levels presently authorized for UHF operations and proposed for VHF operations.[18]

A reduction in power to 20 mW will effectively prevent wireless microphones from making use of the guard bands or duplex gap. The Commission must keep in mind that even the 4 MHz portion of the duplex gap proposed for licensed wireless operations is not clean spectrum. On one side of this 4 MHz, WSDs will be operating at 40 mW or twice the power levels proposed for microphone use. On the other side of this 4 MHz band will be LTE equipment operating at even higher power levels. Given that wireless microphones are already far more susceptible to interference than WSDs, the reduced power requirement for wireless microphones only exacerbates the problem. Furthermore, a reduction in maximum power to 20 mW will render unusable much of the equipment that has been recently purchased following the Commission's decision to clear wireless microphones out of the 700 MHz band. In effect, this would take away any transition relief for users whose equipment happens to operate in the spectrum that is eventually assigned to the guard bands and duplex gap, even in cases where there is no WSD use of that spectrum or adjacent LTE operations during the transition period.

With respect to newly manufactured equipment, the power limits are likewise unnecessary. To the extent that the Commission adopts the ETSI emissions mask as a technical requirement for new microphones as it proposes in the *Wireless Microphone NPRM* there is little concern that newly manufactured wireless microphones will interfere with broadcast stations transitioning off of spectrum that has been repurposed for the guard bands and duplex gap or

[18] *600 MHz NPRM* at ¶ 160

with new post auction LTE operations on the repurposed broadcast spectrum adjacent to the guard bands and duplex gap.

For these reasons, A-T opposes any reduction in operating power for unlicensed wireless microphones and especially reductions below the levels permitted for WSDs utilizing the same spectrum. The Commission's rationale for this reduced power requirement rests at least in part on a faulty assumption that only a single WSD can operate on a single 6 MHz channel at a given location at a given time and that multiple microphone systems will always produce higher aggregate power levels than multiple WSDs. This analysis ignores the fact that wireless microphones do not require a full 6 MHz of spectrum to operate and that the increased aggregate power from multiple microphones may be offset by lower spectrum demands. This proposal also ignores the Commission's prior finding that at currently authorized power levels "there is no significant power disparity between wireless microphones and TV bands devices."[19]

Furthermore, the Commission has conditioned unlicensed wireless microphone use of the guard bands and duplex gap on requirement that the unlicensed microphone users pay to access one of the white spaces databases prior to operation to ensure that their intended operating frequencies are available for unlicensed wireless microphones at the location where they will be used, at least until the end of the post-auction transition.[20] The Commission believes that access to the database is necessary because during the post-auction transition period, there will be a time when TV stations continue to operate in spectrum that will eventually become the guard bands

[19] *TV White Spaces Second MO&O* at ¶82.
[20] *600 MHz NPRM* at ¶¶ 163-164, 197-198.

and duplex gap.[21] This requirement is entirely unnecessary and will effectively deter unlicensed wireless microphones from operating in the duplex gap and guard bands.

Unlike WSDs, the ability to access the Internet and to query databases is not an inherent part of the design or function of wireless microphones. Indeed the Commission has previously rejected proposals to require wireless microphones to adhere to WSD database requirements as impractical and unnecessary.[22] Requiring wireless microphones to incorporate this capability will significantly add to the cost of the equipment as well as degrade performance due to the limitations on current battery technology. It will render all current product in the market obsolete and impose an undue financial burden on consumers, many of whom have recently experienced the financial hardship of replacing their wireless equipment as a result of the 700MHz spectrum auction. Furthermore, there is no record evidence that wireless microphones have caused harmful interference to existing television operations over the many years that they have coexisted in the same spectrum band and there is nothing in the record to indicate why such theoretical interference would be a concern during the temporally limited post-auction transition when it has not been a concern up to this point. The Commission should not forget that television station operations would render a wireless microphone completely unusable long before the microphone could interfere with television reception to any measurable degree and this would be equally true of LTE equipment.

Finally, the Commission must consider that the cost of accessing and acquiring white space database information will present a real obstacle to unlicensed wireless microphone users. Given that the Commission has recently expanded licensing eligibility to include larger venues

[21] *600 MHz NPRM* at ¶163.
[22] *TV White Spaces Second MO&O* at ¶ 31.

and events,[23] the remaining unlicensed users are going to be individuals and very small entities that will be burdened by the fees imposed by database administrators for access to information that they really do not need in the first place.

A-T agrees that designating a nationwide 6 MHz block of spectrum for unlicensed operation in the duplex gap constitutes a "subsequent methodology" under the Spectrum Act and eliminates the need for database access requirement for both WSDs and unlicensed wireless microphones. Likewise A-T supports the Commission's conclusion that there is no statutory requirement to rely on a database access or subsequent methodology with respect to licensed wireless microphone operations. Accordingly, the Commission should not impose a database access requirement on unlicensed wireless microphones as a condition of accessing the guard bands and duplex gap that are eventually established as proposed in the *600 MHz NPRM*.

V. RURAL AREAS

The impact of the loss of the safe harbor channels on wireless microphone operations is further exacerbated by the Commission's proposals to loosen or remove certain restrictions on fixed and portable WSD operations. Specifically, the Commission has asked for comment on a proposal to allow fixed stations to operate at higher output power levels (10 Watts vs. 4 Watts) and at higher antenna heights (exceeding the current 30 meter limit) in "rural areas" than is currently permitted. Increased power levels may be contemplated for portable WSDs as well.[24] The Commission indicates its belief that relaxed standards for WSDs in rural areas could be

[23] *In the Matter of Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band; Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition; Amendment of Parts 15, 74 and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones*, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24, Second Report and Order, 29 FCC Rcd 6103 (2014).

[24] *600 MHz NPRM* at ¶¶ 43-53.

accomplished without disruption to television broadcast services. However, conspicuously absent from its discussion is any analysis of the impact such rule changes would have on wireless microphones.

Throughout the *600 MHz NPRM* the Commission attempts to justify its proposed rules on the basis of providing parity between unlicensed wireless microphones and WSDs. For example, as indicated above, the Commission proposes to reduce power levels for wireless microphones operating in the guard bands and portions of the duplex gap to half the levels permitted by WSDs in order to ameliorate a perceived discrepancy in aggregate power in situations involving multiple microphones operating in the same 6 MHz channel. Similarly, the Commission indicates that requiring unlicensed microphones to access white spaces databases in the guard bands and duplex gap would enhance the ability of wireless microphones and WSDs to coexist on the same spectrum. Indeed, in proposing to eliminate the ability of unlicensed wireless microphones from registering their operating locations, channels and times in the white spaces databases to protect obtain interference protection from white space devices, the Commission indicated that it made this proposal "because in this Notice we are proposing other ways that unlicensed microphones would operate *on an equal basis* with white space devices in the TV bands, the 600 MHz guard bands, and the portion of the duplex gap where we would allow unlicensed operation."[25] The Commission specifically indicated that its decision to impose technical standards and especially power limits for unlicensed microphones that are similar to those applicable to white space devices, was intended to reduce the potential for interference between these different uses.[26]

[25] *600 MHz NPRM* at ¶ 187.
[26] *Ibid,*

The Commission's proposal to allow fixed and possibly portable WSDs to operate at increased power levels in rural areas is directly contrary to its stated aim of providing regulatory parity and would significantly impede both licensed and unlicensed wireless microphone operations. If unlicensed wireless microphone power levels must be set at the same levels as WSDs (and in some cases substantially lower) to avoid interference, it follows that increasing WSD power and antenna heights in rural areas to the higher levels proposed will create new interference with proximate wireless microphones and undermine the Commission's policy of spectrum sharing.

Furthermore, the Commission's rural area proposal undermines the foundational principal of spectrum efficiency relied on by the Commission throughout this proceeding. Efficiency relates not only to the amount of spectrum used, but also the power levels employed by the service provider. It is not spectrum efficient for a provider to operate at power levels that are higher than required, even if it means there is a cost savings achieved in the form of fewer base stations, where such higher powered operations would preclude other service providers from sharing that same spectrum.

A-T acknowledges that in certain situations, coverage to very remote locations may improve if fixed WSDs operate at higher power levels and with increased antenna heights, especially in areas where there are terrain or other obstacles that would preclude closer spacing of fixed WSD transmitters. However, establishing a general rural exemption based only on the amount of white space spectrum available at a given location cannot be justified and undermines the Commission's stated goals to encourage spectrum sharing and efficiency. A more measured approach would be to require WSDs to avail themselves of the Commission's existing waiver procedures to demonstrate on a case-by-case basis why special circumstances require deviation

from the power levels and antenna heights established for general WSD operations. One of the factors the Commission should consider in any such proceeding would be the potential for interference to other operations.

VI. ELIMINATION OF THE SAFE HARBOR CHANNELS

The Commission's decision to remove various restrictions on and make new spectrum available for WSDs is based on its belief that licensed wireless microphones can be adequately protected from interference by reducing the time it takes for all databases to refresh new entries and increasing the frequency of WSD inquiries as to available spectrum at a given geographic location. Based upon this belief, the Commission has proposed to allow itinerant WSD operations below channel 21 and on the safe harbor channels established by the *TV White Spaces Second MO&O*.

The Commission may be correct in its belief but we do not know this for certain at this time. Although the Commission claims that it has gained substantial experience supporting the reliability of the TV band database, in point of fact there has not been a widespread and ubiquitous deployment of WSDs throughout the country and in a sufficient variety of spectrum congestion scenarios to reach any definitive conclusions on how effective the database will function in the post incentive auction environment. Similarly, because of the relative lack of WSD deployment, it has not been uncommon for professional wireless microphone deployments to have neglected to register their operations in the database and rely instead on the safe harbor channels and traditional frequency coordination practices to find spectrum for a particular event. So despite the Commission's comfort level with a handful of WSD deployments, there has been relatively little experience with the database under the type of spectrum congestion conditions that are expected to result from the repurposing of the television bands.

The Commission has indicated that it intends to eliminate the wireless microphone safe harbor immediately upon the effective date of any rules adopted in response to the *600 MHz NPRM*.[27] A-T believes that such a decision would be unwise and would represent an unwarranted departure from the measured and conservative approach that has been consistently employed by the Commission in allowing WSDs to operate on unused broadcast spectrum. In originally deciding to allow WSDs to operate on unused television spectrum, the Commission required that WSDs incorporate effective spectrum sensing capability in addition to database capability as a means to ensure that WSDs would not interfere with wireless microphones. Once it became apparent that WSD advocates oversold the efficacy of spectrum sensing capabilities, the Commission adopted the safe harbor provisions in place of a spectrum sensing requirement and prohibited operations below channel 21 because of the difficulty in accounting for such operations in coordinating frequencies for wireless microphone use at a given location.

A-T believes that a better approach would be to sequence the proposed rule changes so that the safe harbor is removed only after it has been demonstrated that the database can adequately prevent interference to licensed wireless microphones. Thus, proposals to revise power levels, relax minimum separation distances, allow fixed WSAs to engage in co-channel operations and expand the spectrum available for portable WSDs could be implemented concurrently with the revised database requirements with the loss of the safe harbor taking effect only after the incentive auction has occurred and the final configuration of the 600 MHz Band Plan becomes known. This approach would ensure that any problems with the database could be resolved before the safe harbor is eliminated thereby protecting licensed wireless microphones.

[27] *600 MHz NPRM* at ¶ 25.

The delay would also provide unlicensed microphones that have relied on the safe harbor additional time to find alternative spectrum for their operations. Given that unlicensed microphones will not receive any protection from the database, these users will likely be forced to relocate out of the UHF band to avoid interference from licensed services and WSDs. However, the Commission is only now beginning to identify and establish new rules for wireless microphone operations in new spectrum bands and it will take additional time and the investment of significant capital resources for equipment manufacturers such as A-T to develop, test and manufacture new products to operate on any new spectrum the Commission ultimately makes available for this purpose.

At the same time, a delay in eliminating the safe harbor will not unduly burden WSD operations. As indicated above, the Commission has proposed significant changes to its rules governing WSD operations that will provide substantial amounts of new spectrum for WSD operations apart from the safe harbor channels, allowing for more ubiquitous WSD deployment. Increased WSD operations on this new spectrum will provide the operating experience necessary to determine that the safe harbor channels are no longer required to protect wireless microphones in a post incentive auction environment.

VII. INCREASING SPECTRUM AVAILABILITY FOR WIRELESS MICROPHONES

In the *Wireless Microphone NPRM* the Commission has launched a comprehensive review of wireless microphone users, technology and spectrum availability. The Commission seeks to address how to accommodate both short term and long term needs of wireless microphone users given the reduction of the broadcast television band spectrum, used extensively by both licensed and unlicensed wireless microphones, that will be repurposed for

mobile data services following the incentive auction mandated by the Spectrum Act. The Commission has asked for comment on a plethora of issues relating to transitioning existing microphone users out of the 600 MHz Band, how to make wireless microphones more spectrum efficient, how to modify current rules allowing wireless microphones to operate in other frequency bands, and whether to make new spectrum available for wireless microphone use to replace the broadcast television band spectrum that will be repurposed following the incentive auction. A-T fully supports the Commission's efforts to find ways to preserve the important function that wireless microphone serve in our society and specifically supports all of the proposals advanced by the Commission that would make existing spectrum more useful for wireless microphone operations and make new spectrum available for this purpose.

The Commission has asked for comment on the timeframes for developing new microphone products, steps the Commission can take to ensure that microphone efficiency is increased, and incentives that affect the development of new products. A-T has spent years and has invested substantial capital to advance the state of the art for electro-acoustic products, including wireless microphones and in ear monitors. There is no single timeframe that applies to product development although it generally takes years to bring a new product to market. The amount of time needed to develop a product is a function of projected demand, research budgets, technical complexity, amount of testing required, parts/device availability, prototype development, regulatory approvals, negotiating intellectual property licenses, obtaining patent protections and gearing up for production.

Additionally, the potential market may play a significant role in product development. Where the same product can be used both internationally and in the United States there are economies of scale which result in significant cost savings that can be realized by the

manufacturer and the end user, providing powerful financial incentives. Harmonization, or at least close coordination with global regulatory parameters, ensures a faster response time and higher likelihood of new product and technology innovation when product development teams experience this economy of scale and are able to work on fewer projects, on faster timeframes and with better return on investment.

By way of example, in anticipation of severe spectrum crowding and the need for alternatives to traditional FM analog wireless microphone methods, A-T began development of a wireless microphone conferencing system utilizing UWB technology. That development started in 2002 and in 2007 the first "SpectraPulse" wireless microphone product was launched into the installed sound market. However, product development does not stop with the release of product to market. Based upon the experience gained with the initial product launch, A-T continues to undertake additional research into methods to refine and improve the reliability and performance of the UWB platform with the goal of accomplishing a more universal tool for use in wireless microphone applications. As A-T advances this technology platform, it believes there is strong potential for professional product use on a global basis.

Product development is an ongoing process for equipment manufacturers such as A-T as they continue to make their existing products more efficient and to develop new products in an environment where competing demands for wireless spectrum continue to outpace the rate at which new spectrum can be technologically and economically exploited. Manufacturers must be able to anticipate the needs of their clients and the operating environments for their products and this has led to steady and constant improvements to wireless microphone spectrum efficiency. As the Commission itself has acknowledged, wireless microphones historically "have generally

shared frequency bands on a secondary or unlicensed basis with other users" and "must continue to work to achieve greater spectral efficiency over time."[28]

The Commission has requested comments on steps it can take to improve wireless microphone spectrum efficiency.[29] A-T shares that goal but strongly believes that imposing regulatory mandates for spectrum efficiency are unwise and are likely to retard the development of new and innovative products. In fact, it is unnecessary to mandate efficiency. The demand for wireless microphones is constantly expanding. It is not uncommon for an event to require more than 100 microphones, rendering spectrally inefficient products increasingly ineffective for such uses. Rather, the Commission should take actions that provide stability and certainty for wireless microphone operations so that wireless microphone users and content creators will have an incentive to invest in new efficient equipment without fear that the equipment will become obsolete due to technical incompatibilities with later users or regulatory fiat. Simply put, unlike mobile handsets which are upgraded regularly, wireless microphone users do not usually have a need to continually upgrade their equipment prior to the end of its useful life, which can be 10 years or longer.[30] Faced with the prospect of premature obsolescence, a customer will invariably opt to purchase a lower cost and possibly less efficient alternative which creates disincentives for manufacturers to invest in more costly and efficient innovative products.

---

[28] *Wireless Microphone NPRM* at ¶ 3.

[29] *Wireless Microphone NPRM* at ¶ 57.

[30] Accordingly, the Commission must make clear that any new technical specifications adopted in this proceedings for wireless microphones, such as the ETSI emissions mask, would apply prospectively to equipment manufactured after a certain date in order to avoid rendering existing equipment (much of which was recently purchased as a result of the Commission's mandate to clear wireless microphone operations from the 700 MHz Band) unusable and worthless.

The Commission has proposed a number of actions to accommodate wireless microphones. These include revisions to rules in spectrum bands where wireless microphones currently operate to better accommodate wireless microphone operations and revisions to its rules to open up new spectrum for wireless microphone use on a shared basis with existing users of that spectrum. Each of these is discussed briefly.

Initially, the Commission has proposed several revisions to its rules in order to allow wireless microphone to better operate in the broadcast television spectrum that will remain after the incentive auction. Specifically, the Commission has proposed to revise its technical rules for licensed microphone operations on the VHF band, including increasing permitted power levels for VHF microphones to comparable levels allowed for UHF microphones.[31] The Commission has also proposed permitting licensed wireless microphones co-channel operation at locations closer to the television stations (including within the DTV contour) than current distance separation rules permit, without the need for prior frequency coordination, provided that the television signal falls below specified technical thresholds.[32] The Commission has also requested comment on whether to adopt the European Telecommunications Standards Institute ("ETSI") emission mask standard for analog and digital wireless microphones.[33]

A-T supports these proposed revisions but believes that additional steps can be taken to accommodate wireless microphones after the incentive auction. Specifically, adopting the more stringent ETSI emission mask standards as proposed in the *Wireless Microphone NPRM* should allow wireless microphones to operate at normal authorized power levels without the need for the 1 MHz buffer that the Commission has proposed to require in connection with wireless

[31] *Wireless Microphone NPRM* at ¶ 78.
[32] *Wireless Microphone NPRM* at ¶ 81.
[33] *Wireless Microphone NPRM* at ¶ 89.

microphone operations in the post-auction guard bands and duplex gap. As indicated earlier in these comments, the Commission's current proposals in the *600 MHz NPRM* to allow wireless microphones to operate in the guard bands and duplex gap only at reduced power levels (20 mW) and with a 1 MHz buffer are unduly restrictive and will actually prevent wireless microphones from effectively putting this spectrum to efficient use.

A-T also supports the Commission's proposal to provide wireless microphone flexibility in utilizing the travelling frequencies in the 169-172 MHz band that is available for Part 90 licensing on a secondary basis. The principal impediment to greater wireless microphone use under Part 90 is the existence of too few channels. Although the Commission's rules designate up to eight channels available for use, a single entity would only be able to use up to three or four of those channels at the same time due to intermodulation effects. Accordingly, Part 90 frequencies are presently insufficient for anyone but the smallest users. A-T believes that a more flexible channelization scheme allowing manufacturers to determine how best to design products that can work across the entire 169-172 MHz band at the same power levels authorized for LPAS operations, rather than requiring adherence to restrictive and outdated channelization and power requirements, would lead to a more efficient use of that band. Requiring compliance with the ETSI emission mask for newly developed equipment in this band would also help further these goals.

Even more important than rule revisions that will allow manufacturers to develop new products to more efficiently utilize spectrum that is already available for wireless microphone use are the Commission's proposals to make new spectrum available for that purpose. To this end A-T fully supports the Commission's proposal to expand the 944-952 MHz Band currently available for wireless microphone use by 11 MHz to 941-960 MHz, and to investigate the option

of allowing wireless microphones to operate on a secondary licensed basis in the 1435-1525 MHz spectrum. A-T also supports the 2008 petition for rulemaking filed by the Public Interest Spectrum Coalition ("PISC") to create a general wireless microphone service in the 2020-2025 MHz band that could be made available to support unlicensed wireless microphone operations free from WSD interference.

As a final matter, A-T wished to address the potential for ultra-wideband technology to be employed for professional wireless microphone applications both indoors and outdoors and at large venues. In order to allow for professional use, A-T suggests that in addition to the already proposed licensed wireless microphone operation in the 7 GHz band, licensed users also be allowed to operate UWB wireless microphones in both indoor and outdoor locations with the current indoor mask and power levels.[34] Only a slight change to the measurement method of power levels would be needed in order to compensate for the new use case in which the transmitter is worn in very close proximity to the human body thus absorbing approximately 20% of the effective radiated power.

Furthermore, given that this UWB system is being developed for professional use, A-T believes it would be both appropriate and desirable for the Commission to amend its rules to authorize the use of outdoor professional UWB microphone systems on a secondary basis by LPAS licensees, including broadcasters, professional television and cable programmers, and professional sound engineering companies, and operators at major venues that manage and

[34] A-T would note that rules under consideration in the United Kingdom by OfCom that would harmonize UWB rules across Europe allow for outdoor operations at the same levels as permitted for indoor operations. See *Notice of Ofcom's Proposal to Make the Wireless Telegraphy (Ultra-Wideband Equipment) (Exemption) Regulations 2015*, available at http://stakeholders.ofcom.org.uk/consultations/uwb-regulations/?utm_source=updates&utm_medium=email&utm_campaign=uwb-condoc .

coordinate wireless microphone operations. Doing so would further a number of policy objectives identified by the Commission. First, A-T's UWB system fully meets the goals of spectrum sharing and spectrum efficiency enunciated in the *Wireless Microphone NPRM*. UWB operates on spectrum which is licensed for other uses at power levels that are barely detectable. Because of its low power operations, UWB does not interfere with other non-UWB users of the spectrum and thus allows that spectrum to be shared efficiently. Restricting the eligibility of a slightly modified emissions mask to professional users would provide an additional layer of protection for existing primary licensees of the shared spectrum by ensuring that the equipment is installed and operating properly and in accordance with manufacturers specifications and FCC rules. Finally, allowing professionals users to obtain secondary protection under their LPAS licenses for a professional UWB microphone system would provide them with the certainty required that their investment would be protected from unlicensed UWB applications that might interfere with their operations during important events.

VIII. CONCLUSION

Based on the foregoing, A-T respectfully requests that the Commission keep in mind the particular interference vulnerabilities of wireless microphone services and take those vulnerabilities into account as it repurposes the television broadcast spectrum following the incentive auction. A-T understands the Commission's desire to encourage the development of WSDs and the efficient use of broadcast spectrum but it should not forget that the benefits provided by wireless microphones are very real and concrete. These benefits should be protected as the Commission seeks to encourage the development of new services that have been promised by WSD interests. Central to the success of this major spectrum realignment will be the Commission's willingness to adopt flexible rules to allow wireless microphones to make use of

existing spectrum and its ability to open up new spectrum where wireless microphone development can occur in a stable regulatory environment.

Respectfully submitted,

AUDIO-TECHNICA U.S., INC.

By: _____
Jacquelynn A. Green
V.P. R&D/Engineering
Audio-Technica U.S., Inc.
1221 Commerce Dr.
Stow, OH 44224
(330) 686-2600

By: _____
Howard S. Shapiro
Bennet & Bennet, PLLC
6124 MacArthur Blvd.
Bethesda, MD 20816
202-371-1500
Its Attorneys

Dated: February 4, 2015